



Enhancing the Photolytic and Photocatalytic Destruction of Per- or Polyfluoroalkyl Substances (PFAS)



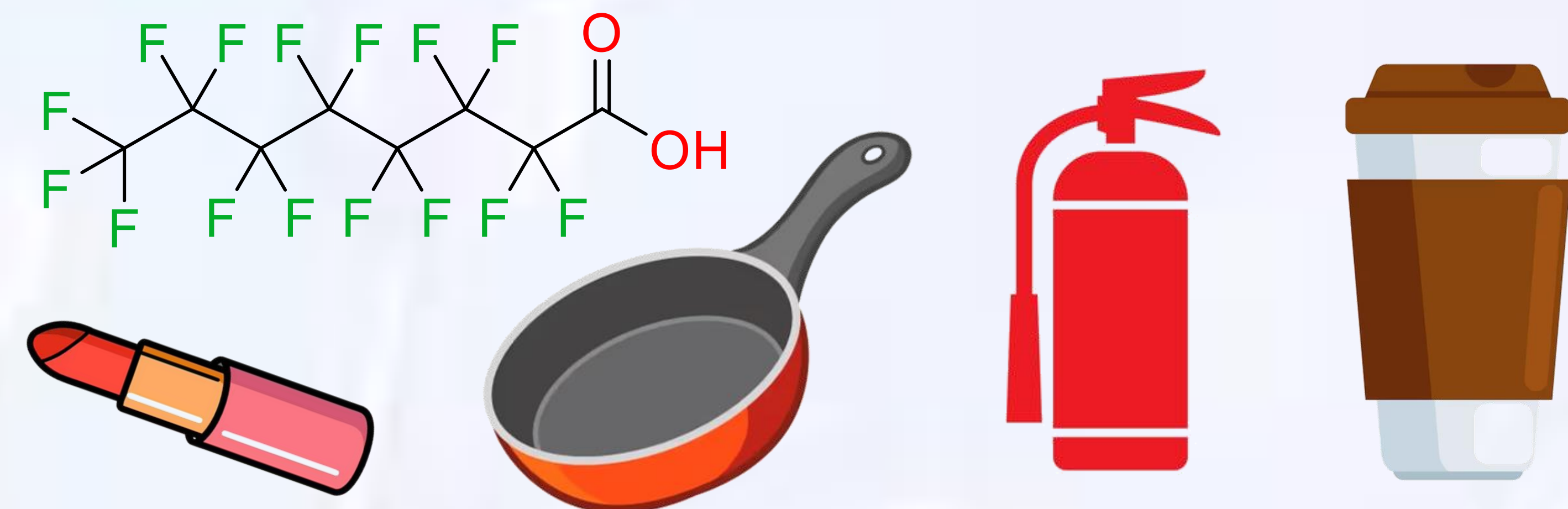
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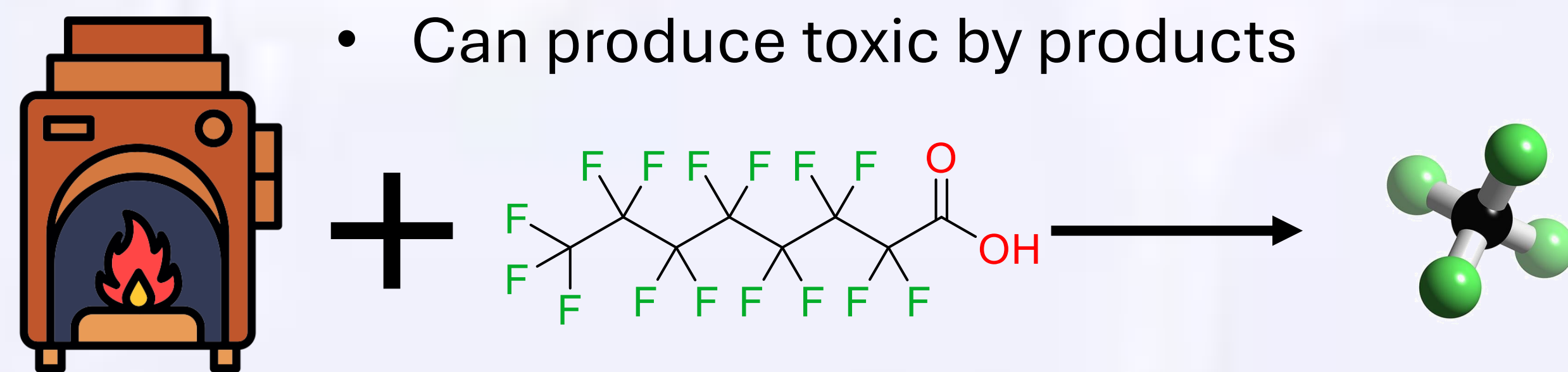
What are PFAS?

- A class of chemicals which contain fluorinated carbon chains
 - Widely used due to water and fire resistant properties¹
- Suspected of causing many health issues, including cancer²

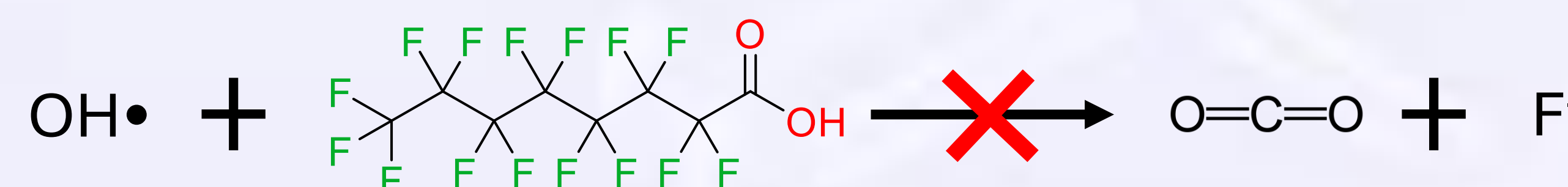


What is the problem with current techniques?

- Incineration requires high temperatures (>1000 °C)
 - Can produce toxic by products



- Advanced oxidation processes typically do not fully degrade PFAS

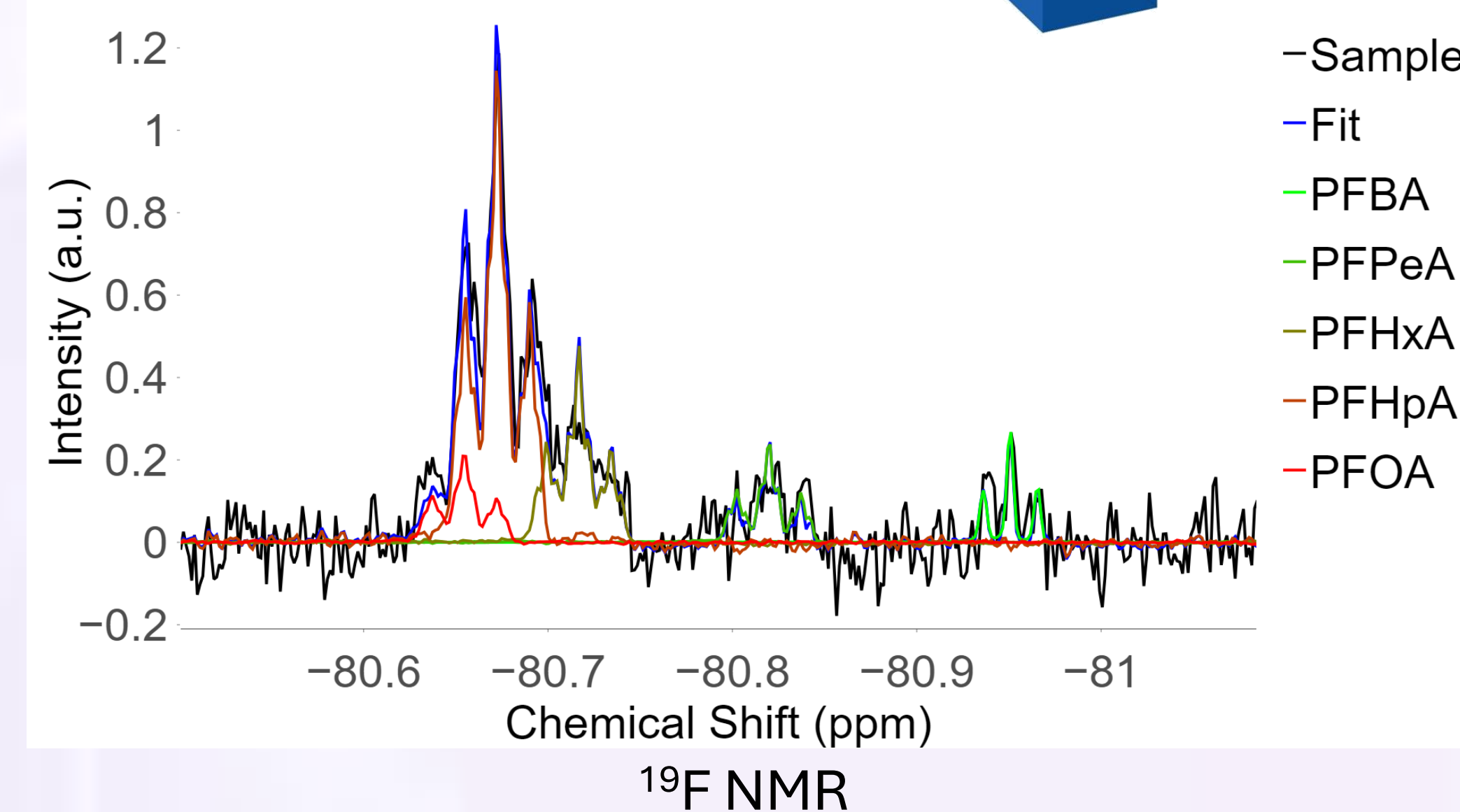
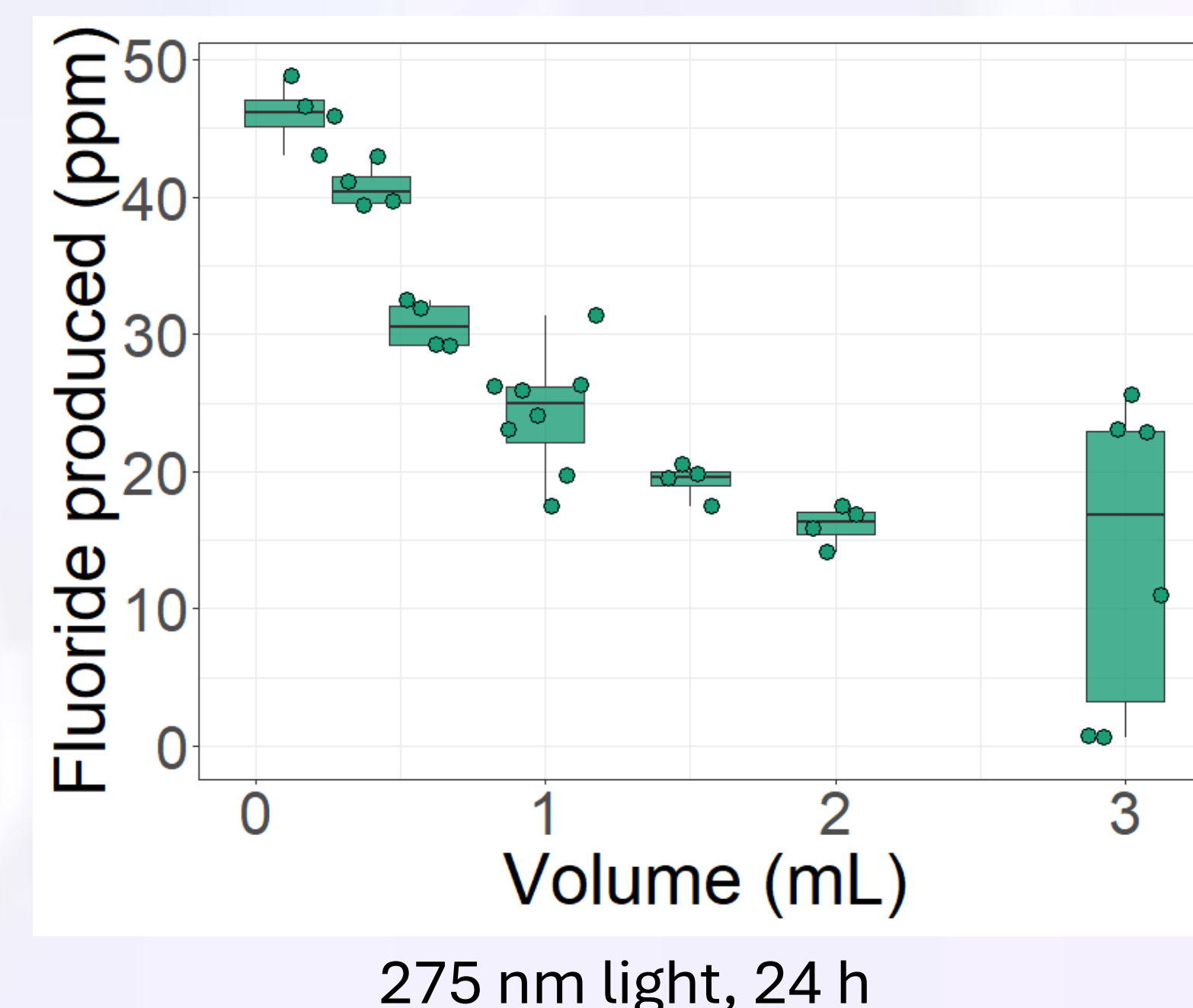


References

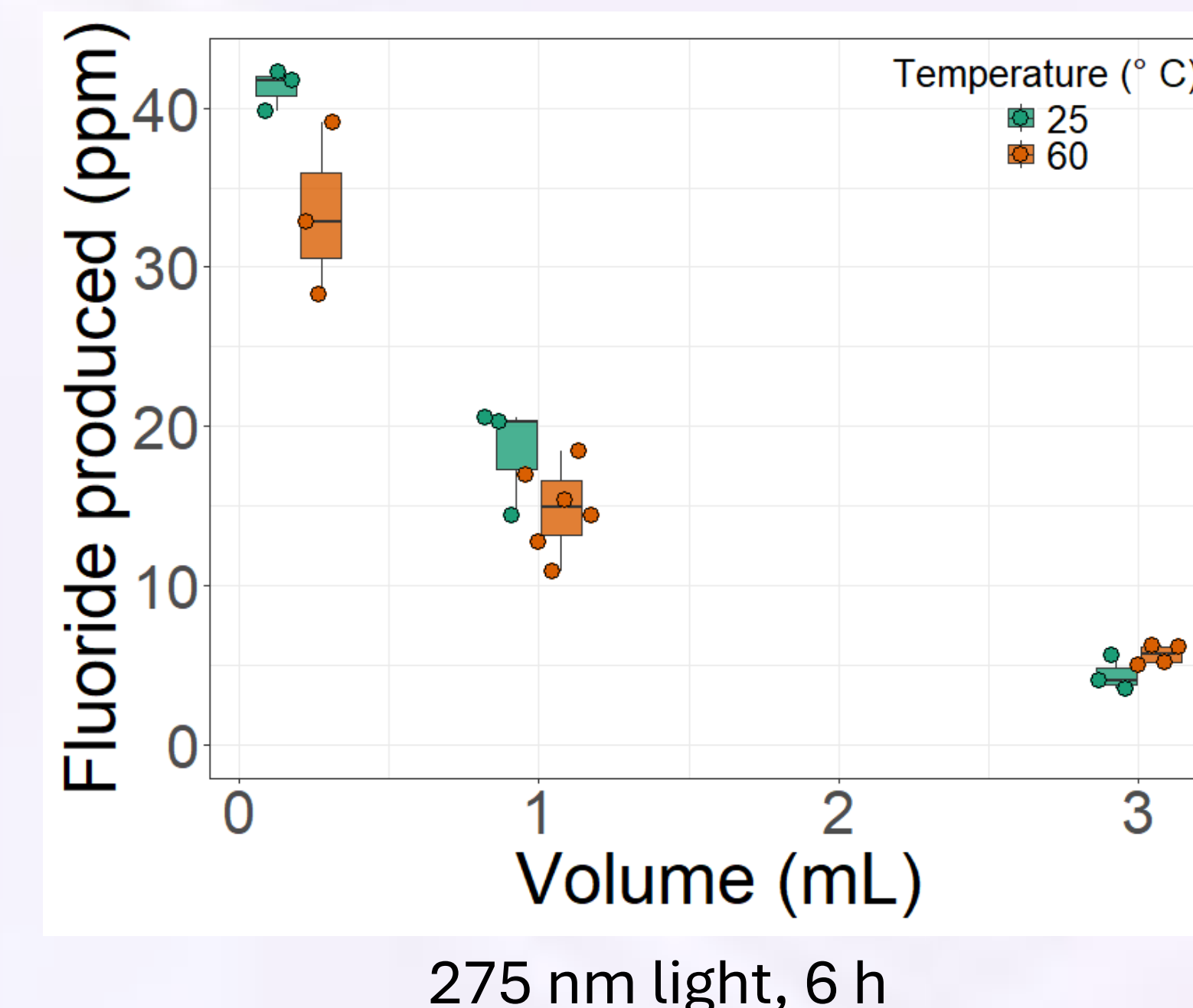
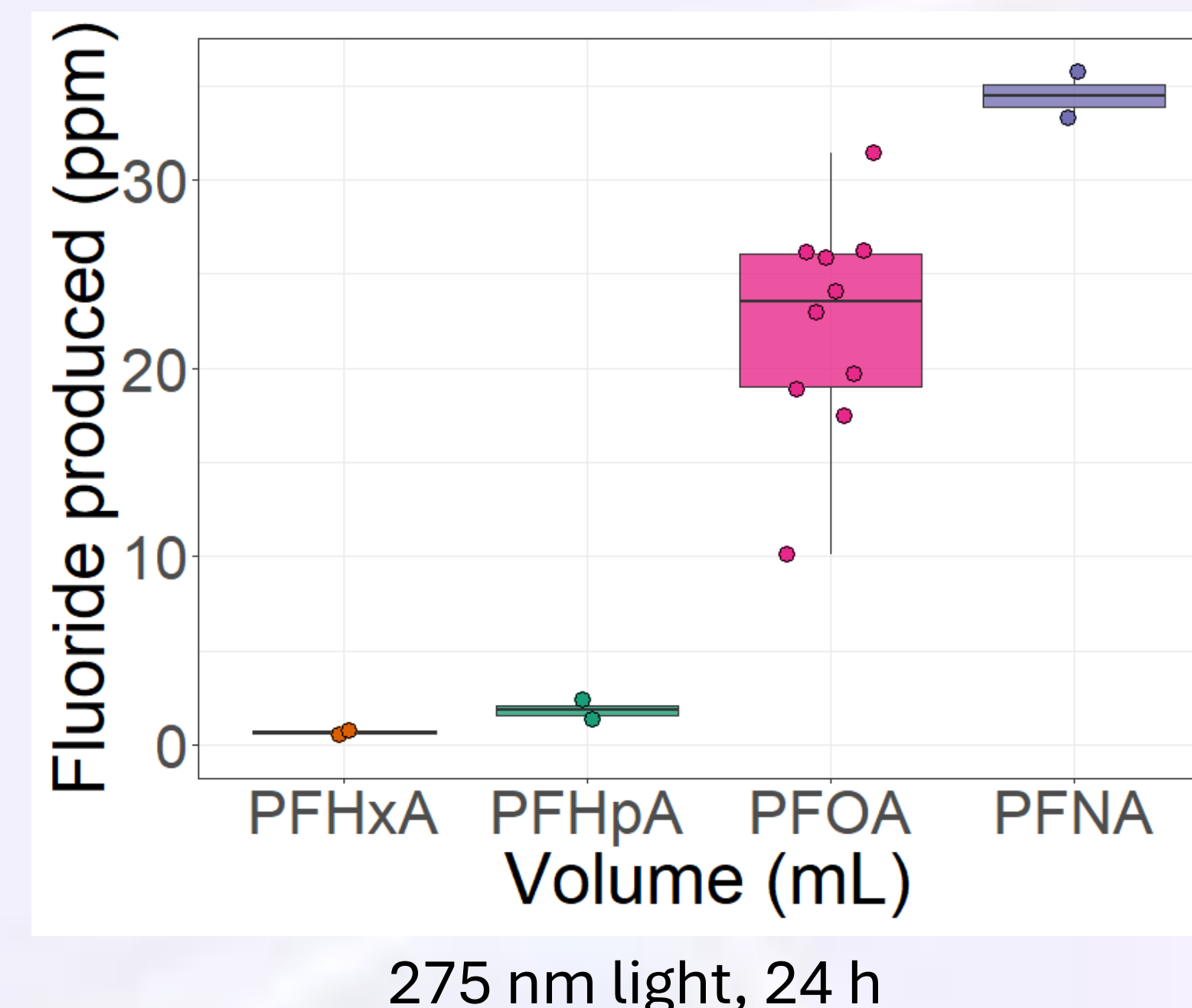
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Photolytic degradation

- PFAS can be degraded with just UV light
- Degradation efficacy enhances as the volume is reduced
- Up to 70 % of fluorine converted into fluoride
- Some shorter chain PFAS formed

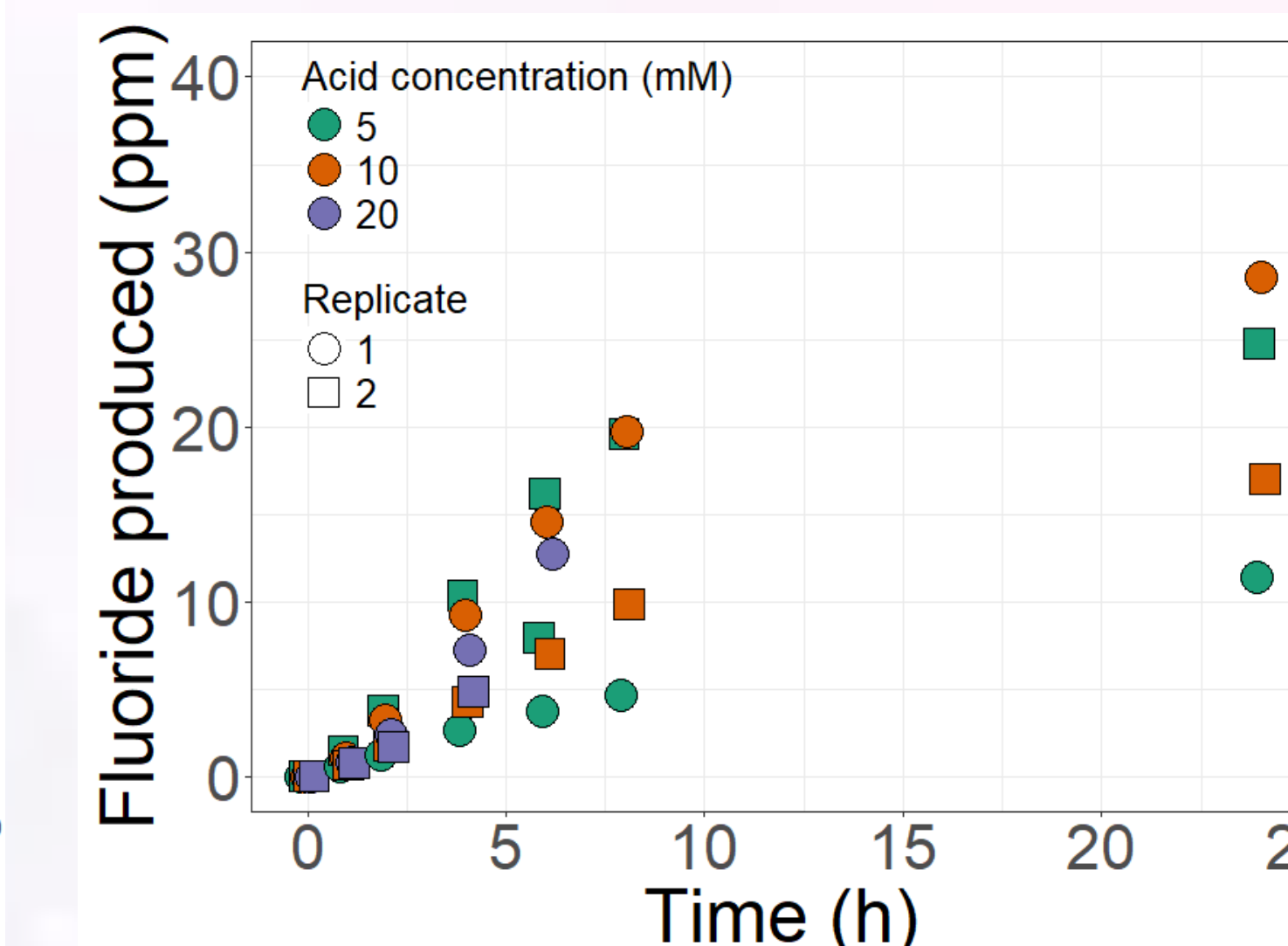
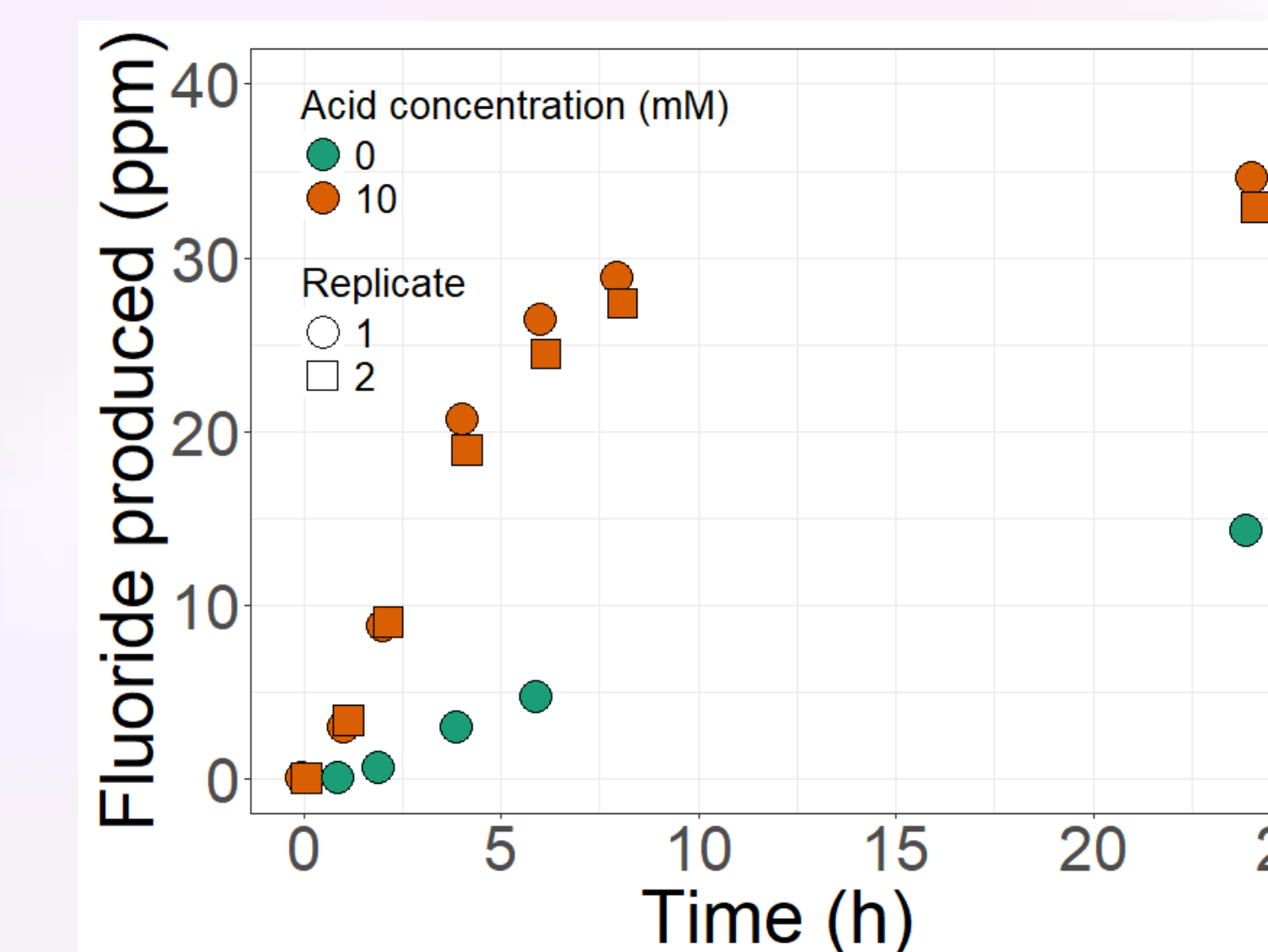
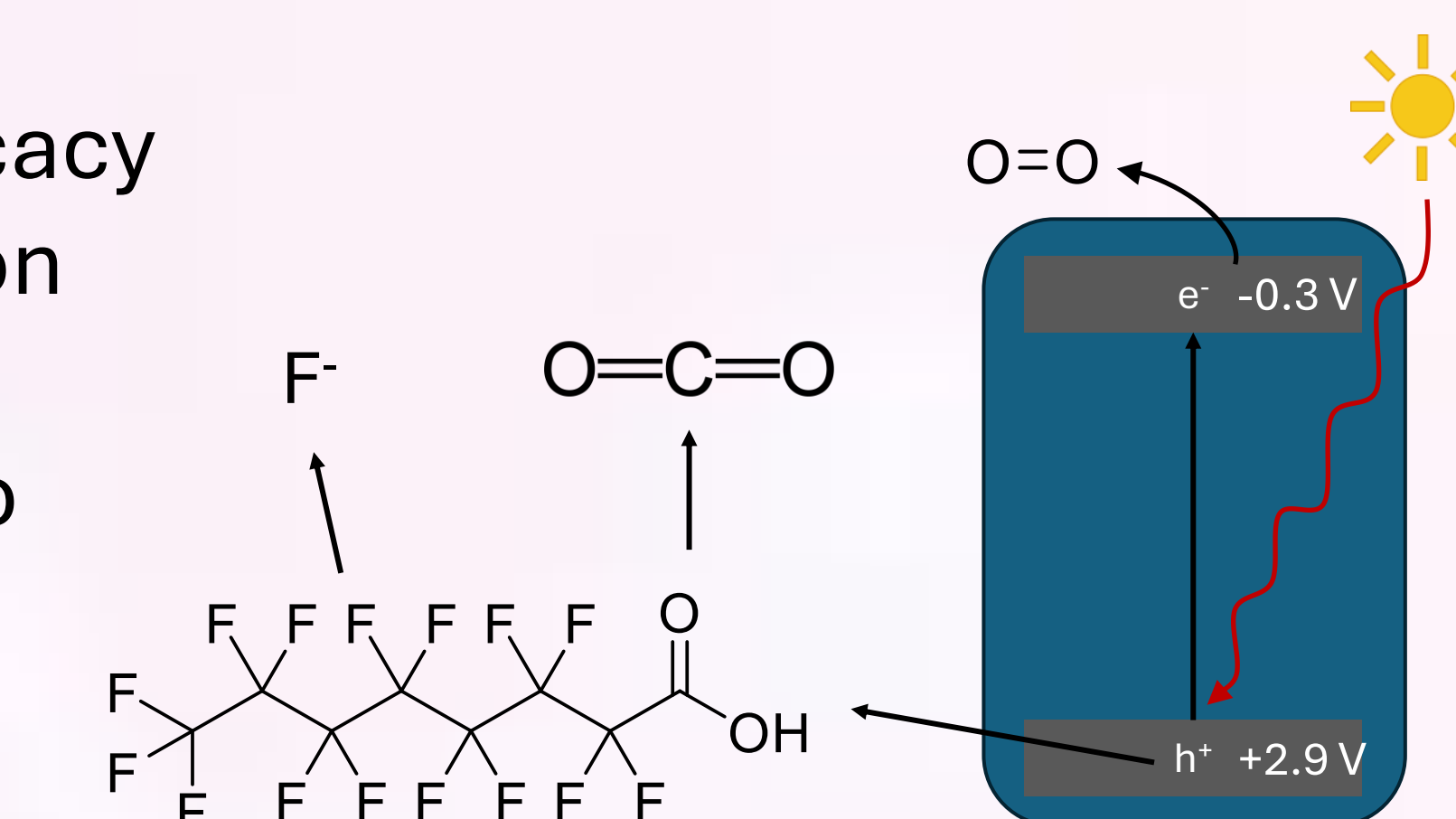


- Lower volumes heated up more from UV LEDs
- Heated photolysis shows this is not the main cause of enhanced degradation
- Varying chain length shows degradation may occur at the air-water interface



Photocatalytic degradation

- Photocatalysts can be used to enhance degradation efficacy
- Titanium dioxide is a common photocatalyst
- Typically used with oxygen to scavenge electrons



Oxygen atmosphere, TiO₂, 365 nm light Nitrogen atmosphere, TiO₂, 365 nm light

- Degradation enhanced with sulfuric acid
- Degradation occurs even without oxygen

Conclusions

- Degradation of PFOA possible by photolysis at 275 nm
- Photolysis may occur at air-water interface
- Addition of sulfuric acid enhances PFOA degradation by TiO₂
- Photocatalytic degradation of PFOA by TiO₂ possible in anoxic conditions